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NPIC/TDS/D/6-1681
16 November 1966

MEMORANDUM FOR: Assistant for Photographic Analysis, NPIC

ATTENTION: [REDACTED]

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SUBJECT: Advanced Film Viewing Light Tables With a Translating
Microscope Carriages

1. In the latter part of 1963 various individuals of your organization were given the opportunity to make suggestions for the improvement of these 9 x 40 Advanced Film Viewing Light Tables.

2. As a result of these discussions, the attached Development Objectives entitled, "Advanced Film Viewing Light Table with a Translating Microscope Carriage" dated 24 March 1964 were formulated. This document was submitted to industry and after a competitive evaluation of the resulting proposals was made it was decided to initiate a parallel effort for this development. From the start it was recognized that of the two contractors selected [REDACTED] had the higher probability of success; nevertheless, because of the importance of this effort [REDACTED] was selected as an alternate or "back-up" supplier.

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3. After two and a half years of intense monitoring by this office and extensive inputs from your organization, the light tables have been delivered. All of the requirements of the Development Objectives have been more or less satisfied; but, as a consequence, the light tables have become relatively complicated in comparison to existing equipment. These units can therefore serve as a "test bed" to determine if all or part of the advanced features should be incorporated into a production version of an advanced light table; e.g., the better features of each light table can be combined into a single production version and the undesirable features eliminated thereby reducing both complexity and cost.

4. Although most of the advanced features are direct and straight-forward solutions, some deserve discussion.

A. The [REDACTED] Light Table

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1. The film transport system can be operated in three modes (manual, power-assisted or fully powered)

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and allow the operator to control the film from a single handwheel in a number of different transport modes. Any combination of film motions can be accomplished with this transport system. The three separate mode feature was incorporated to determine which method is preferred. It is felt that the sensitivity of any mode can be improved when the other two are eliminated.

2. The masking shades are easily operated; however, the center shade is probably better implemented in the [] version. These shades eliminate the stray light from the edges of the film format.
3. The simple push-button film reel holders seem to be an improvement.
4. The film holddown techniques has been devised which eliminates the curling of the film by applying a small uniform tension to the film, and an additional glass cover plate has been added to maintain proper film flatness.

B. The [] Light Table

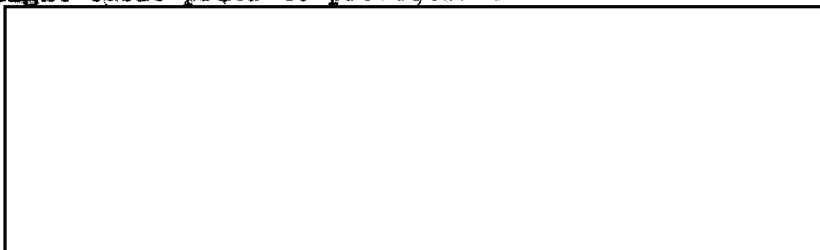
1. The excessive friction in this manual film transport shows that some method of power assist is mandatory. As in the [] Light Table, all combinations of film transport functions can be accomplished.
2. The film reel brackets are positioned simultaneously which eliminates film tracking problems. The masking shades could be attached to this mechanism so that the shades would automatically be positioned when the reel brackets are positioned.
3. The implementation of the microscope movement appears to be very satisfactory on this light table. The excessive friction in the [] movement has been reduced considerably, thereby permitting a uniform motion for scanning, but retaining the required measuring accuracy.
4. The [] light source has a very large dimming range completely without flicker.

5. Constructive criticism is sincerely requested on all of the features of the two light tables from the standpoint

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of the desirability of combining all of the superior features into
a single advanced light table prior to production.

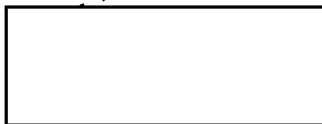


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24 March 1964

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DEVELOPMENT OBJECTIVES

ADVANCED FILM-VIEWING LIGHT TABLE
WITH A TRANSLATING MICROSCOPE CARRIAGE

1. INTRODUCTION.

These development objectives describe the requirements to be met in the design and development of an advanced film-viewing light table with a translating microscope carriage. The proposed table would replace the current models which cannot be adjusted to accommodate different operators. The present tables are generally awkward and uncomfortable to use and do not provide adequate illumination.

CONCEPT.

This table is intended to provide ease of viewing, increased illumination, easy loading, an advanced film transport system and a superior method of translating a microscope over the viewing area of the table. It is to be as light, compact and simple in mechanical design as is possible within the parameters imposed by the specific requirements stated in these objectives.

3. GENERAL DESCRIPTION.

This table shall provide an 11" by 40" illuminated area for use in viewing single rolls of 9 $\frac{1}{2}$ ", 5" or 70mm film, or two rolls of either 5" or 70mm film. This unit will normally be positioned on an elevating or low, fixed table with the unit's viewing surface in a horizontal position, the long dimension extending to the right and left of the operator. The operator will work at the table as he would sit (or stand) at his own desk. Most operators prefer to position viewer close to the edge nearest their side of the supporting table. A movable carriage shall afford translation of a microscope over the viewing area.

4. REQUIREMENTS.

4.1. Illumination System.

4.1.1. Intensity.

4.1.1.1. Range. At full intensity the illumination system must provide at least 1700 foot-lamberts measured at the illumination surface. 2000 lamberts is a definite design goal. Illumination shall not vary by more than 10% between any two points on the entire illuminated surface.

4.1.1.2. Variability. The intensity of illumination shall be continuously variable through a range of 15% to 100% of full intensity without visible evidence of "flicker".

4.1.2. Heat. The light table must be able to be operated continuously at maximum intensity over a 24-hour period, in a room with an 80°F ambient temperature, without exceeding 110°F on any external surface.

4.1.3. Diffuser. An opal glass or similar diffuser shall be located between the light source and the clear glass top.

4.1.4. Shades. Adjustable shades must be provided to mask out all of the viewing surface not actually covered by film. Each of these shades must be located beneath the surface glass, mounted along the long dimension of the unit and extendible across the short dimension. This extensibility must be continuously variable between a minimum extension of (0) zero inches and a maximum extension of 9 inches. These shades must not encroach upon the illuminated viewing area when retracted and, in addition, must be able to be locked in any extended or retracted position.

4.2. External Configuration.

4.2.1. Size. The entire unit shall not exceed 55" in length and 20" in width. Width is exclusive of the crank handles but includes all the components of the translating carriage. The overall height of the light table shall not exceed 7" (minus the carriage, scope and reels). The carriage height shall be kept at a minimum.

4.2.2. Weight. The unit must be as light as possible without sacrificing good stability.

4.2.3. Height Adjustment. A superior adjustment system must be provided so that the entire table can be raised or lowered 3 inches.

4.2.4. Tilt Mechanism. A means must be provided for a 0° through 15° back-to-front tilt of the light table about its long axis. This motion must be simple, smooth, positive and must be able to be locked at any angular tilt within this range.

4.2.5. Comfortable Viewing Position. The light table, the translating carriage and the microscope adapter mounts must be designed to place each of the microscopes at a comfortable viewing height and in a comfortable working position. Human engineering factors should count strongly in the new design. It is understood, of course, that these positions also depend on the height of the illuminated surface, the requirement for the carriage to adequately clear the film and the varying working distances of the microscopes.

4.3. Spool Loading and Holding Mechanism.

4.3.1. Loading Mechanism. A means for the fast loading and unloading of single spools of 9½", 5" and 70mm film or two rolls of either 5" or 70mm must be provided. Rolls will range up to, and including, 500-foot capacity. This loading system must operate quickly and at the same time be positive in action: i.e., it must not drop the heaviest roll spool (9½", 500 feet) no matter how fast or hard the film is cranked. A drop-in film loading system is desirable.

4.3.2. Holding Mechanism. The holding mechanism which engages and secures the spool must be designed for easy one-hand operation -- so that the film can be held in one hand while the holding mechanism is activated with the other. A positive and yet quick release lock must be incorporated.

4.4. Film Transport.

4.4.1. General. A unique film transport system shall permit bi-directional film motion controllable from either end: i.e., it will permit both winding and unwinding with the same crank at one end of the table. This transport system may be either mechanical or electro-mechanical; however, basic simplicity of design and complete reliability are mandatory. Consequently, a purely mechanical system is more desirable.

4.4.2. Film Capacity. The film transport system must accommodate either single rolls of 9½", 5" or 70mm-wide film on either partially- or fully-loaded spools of up to, and including, 500-foot capacity. In addition,

provision must be made for handling two rolls of either 5" or 70mm film simultaneously. These rolls should be mounted side by side with a supporting post in between.

4.4.3. Film Direction. Film spools shall be located at both ends of the long dimension of the viewing area, with the film or films transported along (and parallel to) the long axis of the light table. When two rolls are used, the film strips will travel parallel to each other and to the long axis of the table, with a minimum of separation between strips.

4.4.4. Rollers. Rollers must be designed so that film can be transported either emulsion-up or emulsion-down without scratching. Either the rollers must be of glass or some alternative system provided so that when two rolls of film are used, the alternate rolls can be wound in opposite directions concurrently or one of the two rolls translated while the other roll remains stationary.

4.4.5. Film Tension. The film transport mechanism must maintain a light, constant even tension on the film or films -- just enough to keep the film flat and in contact with the plate glass surface when the film is stationary. This tension should be automatically reduced or eased when the film is moved.

4.4.6. Film Drive.

4.4.6.1. Drive Modes. The film drive must: wind and unwind single rolls of 5"- or 70mm-wide film or two rolls of either 5" or 70mm film; be capable of winding one of the dual rolls while unwinding the alternate roll and/or permit one roll to remain stationary while the other roll is translated.

4.4.6.2. Drive Control. The drive control may be a hand crank or electrical switch; however, if an electrical control is used, it must provide the same degree of control sensitivity as a hand crank.

4.4.6.3. Dual Speed Range. A dual speed range with a high or "slew" speed shall be provided. This could be in the form of a two-speed, mechanical gear train, a two-speed electrical motor, a variable lever arm crank or an electro-mechanical approach.

4.4.6.4. Reliability and efficiency. Whatever the system, it must be very reliable. Each individual hand crank must wind or unwind film very smoothly -- from either its own spool or the spool at the other end of the table. The drive must be a low-friction system which incorporates inertia damping and antibacklash features. The efficiency, reliability and ease of operation of this drive system is one of the most important considerations in this development.

4.5. Translating Microscope Carriage.

4.5.1. General. A carriage shall be provided for translating a stereo-microscope or microstereoscope in both X- and Y-directions over the illuminated format.

4.5.2. Amount of Translation. The optical center of the microscope shall scan an area of 10" by 35". This area shall be centered in the illuminated area, across the short dimension, and shall commence one-half inch from the right-hand edge of the illuminated area. (The right-hand edge refers to the operator's right as he faces the light table.)

4.5.3. Adapters must be provided for mounting three separate microscopes:

They must permit a rapid but stable mounting of any of the above units (with their attendant focusing mechanisms) upon the translating carriage. In addition, this mounting must permit an 180° rotation of each scope so that it may be used parallel to either the X- or Y-axis of the light table and from either long side.

4.5.3.1. Carriage Motion. The carriage motion must be a smooth, positive, low-friction motion which is free of vibration ("chatter"). The friction load must be consistent throughout its range: i.e., a consistent pressure results in a consistent motion with no position of lesser or greater resistance.

4.5.3.2. Locks. Positive locks must be provided to lock the carriage in X and Y at any position of its 10" by 36" travel.

4.5.3.3. Fine Micrometer Motion. A fine micrometer X- and Y-microscope motion must be provided. The total travel of this motion must be ± 2 cm. in both X and Y. This motion shall be a precision, auxiliary motion accomplished once the main translational carriages have been locked in position. This precision motion must be graduated and easily readable. The motion shall be accurate to .001 mm plus .01% of the total distance being measured with a least count of .0005 mm.

4.5.3.4. Rigidity. It is mandatory that the carriage ways be of rigid construction to insure perpendicularity of the X- and Y-axis. These ways (or tracks) must be perpendicular and parallel to the extent that, when one end of the Y track is locked (so that it can not move in X) and a pressure of 5 pounds is applied to the other end (longest possible lever arm) of the Y track, it will not deflect more than .002 inches.

4.6. Miscellaneous.

4.6.1. Construction. Construction shall meet the highest commercial standards.

4.6.2. Shock Hazard. The unit must be grounded and free of all shock hazards.

4.6.3. Warning Light. A warning light must be provided to show when the unit is on even if the (table) light intensity is turned completely down.

4.6.4. Controls. All operational controls must be conveniently located and easily accessible by the operator. Human engineering factors must be thoroughly considered in the design and placement of these controls.